fully distended no more wine or other liquid can be drawn off.

In conclusion, with respect to this apparatus being self-acting and efficient, you are now in a position to form your own opinions; and with regard to its expense, this will, in a measure, depend upon the number or size of the casks to which it is applied. I may mention, however, that while each bung requires to be fitted with two stopcocks, one cistern may be made to supply all the casks in the cellar, and the small funnel and elastic tube being portable, and only used occasionally, will answer for filling up any number of casks. It is scarcely necessary to add, that all the metal coming in contact with the wine should be tinned or silvered.

As a simple invention, I have protected it in this and the adjacent colonies, with the object of at once taking out patents.

Art. VIII.—*On a Plan for maintaining True Time throughout the City, and on the Railways.*

By Mr. R. L. J. Ellery, President.

[Read 8th June, 1868.]

I think everyone will admit that it is desirable that clocks exposed for public reference, or for the regulation of railway or other traffic, should be kept absolutely correct, or at all events, as nearly correct, and consequently alike in their indications, as possible. In this age, time is money to most people; and the value that may be attached to a single minute in many cases, would, I have no doubt, be more than the whole cost of providing the means of maintaining one absolute and reliable measure of time throughout the city. That the clocks which are exposed for public reference in our streets, in the shop windows and at the railway-stations, do differ in their indications, and often to a serious extent, is well known. How many a punctual business man on his way to the railway or to an appointment gets perplexed at the varying value of the precious period yet at his disposal, as he consults various clocks' faces on his road, each professing to indicate true time.

We may not be quite so bad as Paris was a century ago, where Delambre says the same hour could be heard striking in the different parts of the city over at least half-an-hour of

time, but if all the clocks for public use in Melbourne told their own tale with a brazen tongue, we should be surprised at the long period that would be embraced between the striking of those that are fast and those that are slow. Some of our railway clocks indeed appear to be of Captain Cuttle's watch class, which if put on ten minutes in the morning, and back a quarter of an hour in the middle of the day, would be equalled by few, and excelled by none.

The head quarters of all time measurements and regulation are the various public and private observatories which now exist in almost every part of the civilized world. It is a duty of the first and greatest importance in such institutions to obtain and maintain true time with the highest precision, and wherever one has been established the first practical benefit it confers on the public is to afford precise means for the regulation of time. This has usually been done by means of periodic signals indicating some prearranged instant, such as for instance the drop of a time ball, or the flash or boom of a cannon at one o'clock, which enables those so disposed to determine the errors of their timekeepers and to set them right. It would be inconvenient, however, and even injurious to good clocks to set them right every day, and to obviate this it used to be the custom of some clockmakers in London to place a card showing the error of the clock at the time the signal was given. This, as far as the general public was concerned, was almost an useless compromise, for, to be used as a clock exposed for public reference is intended to be used, it should show the right time with its hands without the necessity of a mental calculation. It appears, therefore, that the periodic method of regulating time, although admirably adapted for obtaining errors and rates of superior clocks and ship chronometers, does very little towards the attainment of that horological millennium which I have assumed to be so desirable, and that a method by which the various clocks exposed for public use could be made to go in unison seems to be the only one by which the end required is likely to be reached. It was the necessity of some reliable means for obtaining true time, for the determination of the errors and rates of chronometers belonging to the fleets of merchantmen which then filled our port, and for public purposes generally, that first brought about the establishment of our Observatory in 1853; and now there are few observatories in the world that have such facilities as it possesses for successfully acomplish-

ing any method of public time regulation that may be adopted, possessing as it does the most perfect appliances in the world for such purposes, and among them the magnificent clock, whose performance was declared by the jurors of the late Paris Exhibition to be quite unprecedented.

With such facilities, I should be to blame if I did not avail myself of every opportunity to make them render all the practical service possible to the community; and I am now about to propose a plan for the regulation of public time, which has already been adopted in Liverpool, Glasgow, and Edinburgh, and I think in some parts of London, with great success, economy, and public satisfaction. This plan consists in controlling electrically, by currents from a standard clock, all clocks that may be placed in electric circuit with it, and the method of doing it comprises the laying down of a "time main," and laying on the supply to any clock or establishment requiring it, almost as you would gas. About twenty years ago, Mr. Bain, in London, invented a clock which went by electro magnetism, instead of by a weight or spring; the galvanic current necessary to drive it was very small, and the clock went uncommonly well, but in common with all clocks that depend on a galvanic battery for their motive power, it was liable to failure, and by experience it has been found almost impossible to obviate this uncertainty; this and allied electric clocks, have never, therefore, come into general use. The ingenious contrivance invented by Bain, however, for driving a clock by electricity, has been most cleverly modified and adapted by Mr. Jones, of Chester, for controlling pendulum clocks driven by the ordinary weight or spring, which it accomplishes with the utmost precision and regularity, at a very slight cost, and above all, involves no special clocks, nor any great alterations in the clocks it is desired to control.

The plan is this—the Observatory clock is furnished with a second wheel on the escape-wheel arbor, which has thirty teeth, each tooth of which in passing brings a pair of light springs in contact for about 1-10th of a second at every escape; but there are two sets of springs, and one set is brought into contact at the even and the other at the odd seconds of the clock. These springs are insulated one from another, and are armed with platina at the points of contact. We will call the springs *A* and *B*, and the points they touch, common to both, *C*: so that at the even second *A* touches *C*, and at the odd *B* touches *C*. A galvanic battery with 2 (or

multiple of 2) cells is now arranged, so that the positive pole of one cell is connected with *A*, and the negative of the other with *B*; the other positive and negative poles are joined together and connected with *C*. Now as the clock goes, and the springs *A* and *B* are alternately brought into contact with *C* each second, an alternately positive and negative current will flow along the wire to *C*. Any length of wire may now be interposed between the contact piece *C* and the united poles of the battery, and this wire will form the time main.

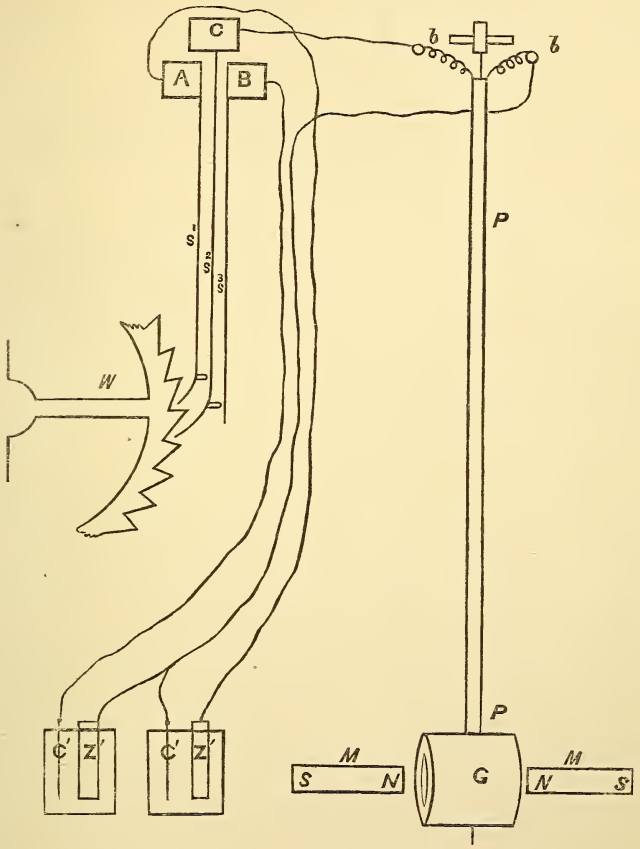
If we wish to lay on the supply to any other seconds pendulum clock to control it, the following arrangements have to be made. A pendulum bob, formed of a hollow bobbin of covered copper wire, has to be fitted on to the pendulum instead of the one hitherto used in the clock to be controlled. The two ends of the copper wire are led insulated up the pendulum-rod to the suspension-spring, where they are coiled into spirals (so as to offer no resistance as the pendulum swings) and made to terminate in two binding-screws on the clock case. Two permanent magnets have now to be fixed in such a way that as the pendulum swings the hollow ends of the bobbin just enclose the ends of the magnet at the end of each oscillation. The time main is now led to one of the binding-screws holding one end of the pendulum wire, and led on from the other screw to other clocks or to the ground, which will form the return wire.

Now supposing the circuit complete and the Observatory clock going, it sends its alternating positive and negative currents through *C* along the time main and into the pendulum, and by a well-known law converts the bob into a magnet with two poles at every current, and as the currents are alternately positive and negative, the poles of the bob will also alternate. Suppose we set the pendulum swinging, and it arrives at the end of its swing to the left with a north pole, it meets with the *N* pole of the magnet, which tends to repel it, while the opposite end of the bob being S. is attracted by the right hand magnet as it swings to the right. The right side of the bob is now N., and is again repelled by the magnet on the right until, in a very few seconds, it commences to swing so that the ends of the bob are always S. as they approach the N. poles of the permanent magnets; and once oscillating in this manner, it is, so long as the currents flow properly from the standard clock, a difficult thing to make the controlled clocks go any other way

except in exact unison with the controlling one. Even if its tendency was to lose or gain many minutes a day it cannot do it, and it would continue to show the same second as the Observatory clock so long as the currents along the time-main continued. The great advantage of this method is that even should any failure take place in the Observatory clock or in the currents, the clocks would continue to go as well as before adopting the control, but being governed only by their own pendulums would be liable to the losing or gaining rate belonging to them.

To carry this method into practice in Melbourne it would be necessary to lead another wire on the telegraph posts already erected to such parts of the city as it is likely to be required—certainly to the railway stations. Post-office, Telegraph-office, and, perhaps, other public buildings. This would not cost much—a couple of hundred pounds would probably do it for the whole city. A small rent for the use of the time supply could be charged, which I feel confident would be readily paid, and which would render good interest on the outlay. The new pendulum bobs and magnets could be easily made and fixed by any intelligent mechanic, according to a pattern which would be generally adopted. Those using the control would have nothing to do with batteries, nor would they have any trouble beyond keeping the wires intact.

If this plan should be carried out, and I hope and believe it will, we should, instead of the state of public time-keeping I alluded to at the commencement, have all the clocks controlled, showing identically the same time, and all correct to a second. In Glasgow, as an extra security to the public, it is made a *sine qua non* that those using the supply should have a small, simple, galvanometer beside their clock, which shows by right and left deflections of its needle the alternating currents, and also by an omitted deflection at the sixtieth second of each minute, if the controlled indicates the same second as the Observatory clock. The heavy two seconds pendulum of large turret clocks can be just as readily controlled by the same main, by a different disposition of the permanent magnets. I am not aware that any method of controlling half seconds pendulums in this manner has yet been devised, but I am now engaged in some experiments on controlling, and I think a method applicable to half seconds pendulums, with the same currents, can be arranged.



W part of the 30 teeth wheel on the escape wheel arbor; s^1 s^2 s^3 the contact springs; *A B C* the spring blocks; *P P* the pendulum; *b b* binding screws at the controlled clock; *M M* magnets; *G* the hollow coil forming bob of pendulum; *C'Z' C'Z'* the two cell galvanic battery.